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CIM 208-Vol. I / January 1992

Job Performance Tests for CH-53E Helicopter Mechanics

Volume I: Hands-On Performance Test

Paul W. Mayberry
Neil B. Carey

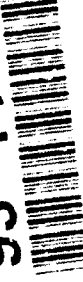
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Subj: CNA Information Memorandum 208

Encl: (1) CNA Information Memorandum 208, Job Performance Tests for
CH-53E Helicopter Mechanics, Volume I: Hands-On Performance
Test, by Paul W. Mayberry and Neil B. Carey, Jan 1992

1. Enclosure (1) is forwarded as a matter of possible interest.
2. Hands-on performance tests and job knowledge tests were developed for MOS 6115 (CH-53E helicopter mechanic) as part of the Marine Corps Job Performance Measurement Project. The purpose of this information memorandum is to disseminate these performance measures to Marine Corps personnel managers, training instructors, and interested researchers who may find them useful.
3. This work comprises two parts: this volume contains the hands-on performance test, and a second volume presents the administrative duties and job knowledge tests.

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Job Performance Tests for CH-53E Helicopter Mechanics

Volume I: Hands-On Performance Test

**Paul W. Mayberry
Neil B. Carey**

Operations and Support Division

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CNA 1992
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ABSTRACT

Hands-on performance tests and job knowledge tests were developed for MOS 6115 (CH-53E helicopter mechanic) as part of the Marine Corps Job Performance Measurement Project. The purpose of this information memorandum is to disseminate these performance measures to Marine Corps personnel managers, training instructors, and interested researchers who may find them useful.

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INTRODUCTION

The Marine Corps Job Performance Measurement (JPM) Project is a major effort to measure on-the-job performance of enlisted Marines. The performance measures are used to validate the enlistment test that selects and classifies military recruits. The performance tests also have value in providing unit commanders and training instructors with detailed information concerning the relative strengths and weaknesses of their personnel.

Representative military occupational specialties (MOSSs) within the mechanical occupational field were selected for performance measurement. Hands-on performance tests and written job knowledge tests were developed. This document contains the performance tests for the CH-53E helicopter mechanics that were tested (MOS 6115). A forthcoming CNA research memorandum will detail the test development process. The purpose of this document is to disseminate these performance measures to Marine Corps personnel managers, the training community, and interested researchers who may find them useful.

The performance measures are organized into the following sections:

- Hands-on performance tests with equipment/materials required for testing and procedures to set up each testing station
- Tests of administrative duties
- Job knowledge test with correct alternatives noted.

The test development and administration were conducted by the American Institutes of Research under subcontract to the Center for Naval Analyses.

HANDS-ON PERFORMANCE TEST

The hands-on performance test for the CH-53E helicopter mechanic MOS (6115) was composed of 16 tasks organized into 8 testing stations. Table 1 is a list of all tasks and the testing stations where they were administered. For each task, the equipment and materials required for testing are also listed. Procedures to set up the testing station before testing a Marine are noted. Specific notes to the test administrators detailing scoring instructions and certain performance conditions to be aware of are listed for each step.

Table 1. Hands-on tasks for CH-53E helicopter mechanics
(MOS 6115)

Station	Performance Task
1	Turn off/on auxiliary power unit Troubleshoot flight controls Adjust flight control rod Ground handling and taxiing
2	Remove/replace accessory gear box drive shaft
3	Adjust pitch control rod Remove/replace rotating scissors and shims
4	Remove/replace mechanical screwjack Troubleshoot power plant fuel system
5	Remove/replace collective pitch bellcrank
6	Troubleshoot main rotor head Remove/replace main rotor
7	Troubleshoot main gear box chip detectors Remove/replace power train accessory gear box oil filter Troubleshoot power plant oil system
8	Remove/replace power plant fuel boost pump

- 1 CH-53E
- 1 TM A1-H53BE-NFM-900, change 2, pp. 11-12)

Procedure to Set Up Station

1. Ensure accumulator is discharged.
2. Set the following switches and levers to:
 - a. Switch VHF, UHF, and TACAN to ON (step 3).
 - b. Turn exterior/interior lights to ON (step 6).
 - c. Turn ramp control power switch to Pilot and OPEN (step 8).
 - d. Turn blade/pylon switches to BLADE TO FOLD and PYLON TO FOLD (step 9).
 - e. Push forward #1 and #3 control levers (step 10).
 - f. Turn emergency start switch to EMERGENCY (step 11).
 - g. Push #3 fuel lever to copilot (step 13).
 - h. Turn anti-ice switches to HIGH (step 14).
 - i. Turn high press rotor brake to OFF (step 15).
 - j. Move APP control switch to OFF (step 17).
 - k. Pull down LOW OIL PRESSURE circuit breaker and HIGH TEMPERATURE circuit breaker (step 19).
 - l. Move APP control lever to OFF (step 21).
 - m. Move #1 and #3 generators to OFF (step 22).

Procedures To Be Performed Before Testing Each Marine

1. Set switches and levers as above.

Procedures to Score and Administer Test

1. Do not start the auxiliary power unit.
2. When scoring step #3 the Marine must have all three switches to ON to receive a GO.
3. Test Administrator can sit in the Copilot Seat (or jump seat) to score test.

This test covers your ability to start and shut down the auxiliary power unit. We will not actually fire up the auxiliary power unit. Rather, proceed through the prestart and start procedures verbalizing each procedure as you do it. Any questions? Begin.

1. Checked pitch lock position.
2. Ensured that ICS and radio control panel switches are ON.
3. Positioned COMM and NAV switches to OFF. (Three switches.)
4. Ensured EMERGENCY control panel switches are OFF and COVERED.
5. Ensured refuel panel switch is OFF.
6. Turned exterior/interior lights to OFF.
7. Ensured FM antenna is in RETRACT or AUTO position.
8. Turned ramp control power switch to OFF and HOLD.
9. Turned blade/pylon switches to OFF.
10. Turned engine speed control levers to SHUTOFF.

11. Turned EMERGENCY start switch to NORM.
12. Ensured engine fire T-handles are FORWARD.
13. Turned fuel selector levers to SHUTOFF.
14. Turned anti-ice switches to OFF.
15. Turned high press rotor brake to EMER.
16. Ensured generators are OFF.
17. Moved APP control switch to ON position.
18. Moved APP emergency T-handle to FWD position.
19. Set automatic shutdown circuit breakers.
20. Visually checked fuel quantity.

Assume that the APP has started and you have 100% engagement. What do you do next?

Assume the APP has operated for some time. You now are to shut down the auxiliary power unit. Any questions? Begin.

21. Moved APP control lever to START.

22. Switched No. 1 and No. 3 generators to ON.

23. Ensured parking brake is set.
24. Turned #1 and #3 generator switches to OFF.
25. Ensured accumulator has 3000 psi.
26. Pulled APP handle aft securing APP.

- 1 CH-53E
- 1 TM A1-H53BE-MRC-400 (1 January 1988)
Cards B-24-B24.5
Flashlight
Dial indicator
6" C-clamp
Mirror

Procedure to Set Up Station

1. Remove top bolt from follow-up arm to roll damper (step #4).
2. Invert directional control pivot arm bolt (step #11).
3. Open #1 and #2 electronic compartment door.

Procedure to Administer and Score Test

1. Many of the task steps call for "inspections" which are not observable behavior. Marine must tell you what he/she is looking for to score these steps GO or NO-GO.

The pilot reports abnormal flight control noise in rudder pedals during APP check. Troubleshoot directional cockpit flight controls using this chart. Tell and show me what you are doing and what you find. Do you have any questions? Begin.

Next, pilot reports excessive slop left to right in cyclic stick. I will move the cyclic stick, you tell me what you're looking for.

-
1. Inspected bellcranks and rods for cracks, corrosion, and distortion.
 2. Inspected attachment hardware and locking devices for security (tightness).
 3. Inspected bellcrank and rod end bearings for looseness and binding.
 - *4. Marine detected missing bolt.
-
5. Inspected control rods for cracks and corrosion.
 6. Inspected control rods, bellcranks and spring cylinders for security of attaching bolts.
 7. Inspected boots for deterioration and rips.
 8. Inspected rod end bearings for wear, binding, corrosion, ratcheting, and freedom of movement.
 9. Inspected bellcranks for cracks, distortion, and worn bearings.
 10. Inspected torque shaft for corrosion, damage, and interference with other components.

Now, troubleshoot the Y bellcrank closest to the lateral servo. [Point.] The pitch locks have been engaged and the hydraulic and electrical power has been turned off.

- *11. Marine detected inverted bolt.
- 12. Attached dial indicator to main gear box.
- 13. Applied (alternately up and down) manual force at rod attachment points.
- 14. Measured vertical play at rod attachment points with dial indicator while applying force. .
- 15. Marine indicated play did not exceed 0.062 inch. (No maintenance action necessary.) ...

CH-53E

TM A1-H53AD-140-000, 006 06, pg. 8-9

- 1 Adjustable flight control rod with 1 fixed end and 1 adjustable end
- 2 Adjustable wrenches
- 1 Tape measure
- Lockwire
- Table

Procedure to Set Up Station

1. Set adjustable flight control rod, rod end, tape measure, wrench, and lockwire on table.

Procedures To Be Performed Before Testing Each Marine

1. Disassemble adjustable flight control rod.
2. Remove jamnuts from rod end.

Procedures to Administer and Score Test

1. Verify length of adjustable control rod when Marine has completed the adjustment.

This task covers your ability to assemble and adjust this flight control rod to its basic length. This is Flight Control Rod #13. Do not torque. Wrench tighten the jamnut. Do you have any questions? Begin.

NOTE TO SCORER: Marine must repeat steps 1 and 2. Verify length when Marine has completed the adjustment.

1. Screwed adjustable rod ends into flight control rod.
2. Measured length of flight control rod from centers of fixed end and adjustable rod end.
3. Tightened jamnut wrench tight.

- *4. Marine adjusted flight control rod to correct length.
5. Checked thread engagement by trying to pass lockwire through inspection hole.

Equipment/Materials Required

NT-4 Universal aircraft tow bar
Tow bar

Ground Handling and Taxiing

Prepare the helicopter for towing by attaching the tow bar. I will assist you if necessary. Do you have any questions. Begin.

Now remove the tow bar. Any questions? Begin.

Now assume you are the taxi director. Show me the proper signal for each command I tell you. Any questions? Begin.

I have command.

Start engines.

Engage rotors.

Insert chocks.

Remove chocks.

-
1. Positioned the tow bar directly in front of the aircraft.
 2. Centered the nose wheel assembly between the tow bar ends.
 3. Inserted pins in corotating shaft and properly located chain.

 4. Removed the tow bar by extracting pins.
 5. Pulled the tow bar away from the aircraft.

 6. Held right hand open palm forward, motionless, and high above the head.

 7. Pointed to engine to be started with left hand, then moved right hand in a clockwise circular motion.

 8. Pointed to rotor head with left hand and twirled right hand in a clockwise circle.

 9. With arms down, fists closed, thumbs extended inward, swung arms from extended position inward.

 10. With arms down, fists closed, thumbs extended outward, swung arms outward.

Move ahead.

Right turn.

Left turn.

Stop.

Slide to the left.

Out engines.

Brakes on.

Brakes off.

Move back.

Personnel approaching aircraft.

-
11. With hands raised to eye level above shoulders, palms backwards, moved arms repeatedly forward and backwards.
 12. Pointed left arm downward and moved right hand repeatedly forward and backward at shoulder height.
 13. Pointed right arm downward and moved left hand repeatedly forward and backward at shoulder height.
 14. Held arms crossed above the head, palms out.
 15. Pointed left arm downward and right arm extended upward at a slant.
 16. With one arm pointing at engine, moved other hand sideways across throat, palm down.
 17. With arms above head, hands open, and palms facing aircraft, then closed fist.
 18. With arms above head, hands closed, then opened fists.
 19. With arms by sides, palms facing forward, swept both arms forward and upward repeatedly to shoulder height.
 20. Raised left hand overhead, palm toward aircraft. With right hand, repeatedly pointed horizontally to personnel and aircraft.

Hot brakes.

Engine on fire.

21. Pointed to wheel with one hand, and made a rapid fanning motion in front of face with the other hand.

22. While pointing to the fire area with one hand, other hand described a large figure eight in front of body.

- 1 CH-53E
- 1 TM A1-H53BE-260-000 WP010 00 pp 3-4
Flashlight
9/16" wrench
7/16" wrench
- 2 Nets
Conical washers
Rags
Washers
Bolts
Nuts
Slot head screwdriver

Procedure to Set Up Station

1. Apply rotor brake.
2. Turn off all electrical power.
3. Position rotor head to allow clearance.
4. Open fairing.
5. Place net under each end of the drive shaft.

Procedures To Be Performed Before Testing Each Marine

1. Ensure drive shaft is properly installed.

Procedures to Score and Administer Test

1. In Steps 4, 5, and 10 have Marine show and tell you what he would do.
2. In step 9 do not torque, wrench tighten only.
3. Scorer may assist Marine by handing bolts, holding flashlight and drive shaft.

You are to remove the accessory gear box drive shaft as you would in the field and, if it is OK, replace it. Here is a Work Packet extract on the task for you to use if you want. I will assist you if necessary. Any questions? Begin.

Tell me what you would do next.

Now, replace the drive shaft. If you would oil or grease anything, tell me. Begin.

Tell me would you would do next.

-
1. Removed all nuts, conical washers, washers, and bolts that connect the drive shaft to the disc assembly at the accessory gear box.
 2. Removed all nuts, conical washers, washers, and bolts that connect the drive shaft to the disc assembly at the main gear box.
 3. Removed drive shaft.
 4. Said would inspect the drive shaft for cracks, loose rivets, nicks, scratches, and corrosion.
 5. Said would inspect the disc assembly for cracks, dents, nicks, elongation of bolt holes and fretting around holes.
 6. Positioned and supported shaft between the flanges of the main and accessory gear boxes. (Installed with splined flange forward.)
 7. Said would coat all conical washers with oil (MIL-L-23699).
 8. Placed the conical washers on both sides of the disc assemblies.
 - *9. Installed all bolts, washers, and nuts as shown in the drawing.
 10. Said would torque all nuts 109 to 121 pound-inches, then to 219 to 242 pound-inches, then to 328 to 362 pound-inches (CDI).

- 1 CH-53E helicopter
- 1 TM A1-H53BE-150-000 005 00, change 3-15, October 1983, pg. 17
- Torque wrench
- 15" crescent
- Crows foot
- Safety wire (.32)
- Open-end wrench
- Safety wire pliers

Procedure to Set Up Station

- 1. Have all tools and the TM in clear view.
- 2. Turn off all electrical power.
- 3. Unlatch and open #2 engine oil cooler and main gear box work platform.

Procedures to Score and Administer Test

- 1. Alternative rotation (clockwise/counter-clockwise) of pitch control rod when testing Marine.

Procedures To Be Performed Before Testing Each Marine

- 1. Zero torque wrench after each Marine.

The pilot performed an autorotation check. The auto turns were 3% High (Low). Make the adjustment on this pitch control rod [point]. Do you have any questions? Begin.

NOTE TO SCORER: The bellnut must be loosened first to avoid damage to lock tang.

NOTE TO SCORER: Verify torque.

NOTE TO SCORER: Marine must fulfill the following requirements to receive a GO for step 9. a) Pulled in rightening direction.
b) Lockwire was tight. c) Twisted evenly. d) Pigtailed lockwire (end curled under).

1. Removed lockwire.
2. Loosened pitch control rod bellnut with wrench (left-hand thread), until safety tang is disengaged from slot on link.
3. Loosened locknut (right-hand thread).
4. Performed steps 2 and 3 in sequence.
5. Adjusted pitch control rod by turning the link clockwise (or counter-clockwise) 1 full turn.
6. Tightened bellnut be hand until safety tang is fully engaged in slot.
7. Torqued bellnut and locknut to 200-250 inch-pounds.
8. Lockwired both bellnut and locknut, using three-point system, with lockwire (MS20995NC32).
9. Lockwired link to locknut correctly.

Equipment/Materials Required

Remove/Replace Rotating Scissors and Shims

1 CH-53E
1 TM A1-H53BE-150-000 012 00, change 10, 15 June 1987, pp. 1-4
Rawhide mallet
Upper shims for rotating scissors
Wrench
Flashlight
Feeler gauge or card stock
Notepad and pen
Cotter pins
Micrometer
Safety wire pliers
Knife
Rags

Procedure to Set Up Station

1. Break torque on nuts on rotating scissors, re-tighten with wrench, and install cotter pins.
2. Remove several shims to simplify replacement steps.

Procedures To Be Performed Before Testing Each Marine

1. Install all rotating scissor components correctly before testing.

I want you to remove the H-link portion of the rotating scissors and replace the shims. Do you have any questions?
Begin.

I want you to replace the shims and install the bolt.

When would you stop shimming?

Assume you are within allowable limits. Use these shims and continue with the task. [Hand Marine original shims.]

1. Removed bolt, nut, washers, cotter pin, and laminated shims attaching pressure plate lug to H-link.
2. Retracted H-link.
3. Loosely installed bolt through upper link and pressure plate lug.
4. Took gap reading on each side of lug with feeler gauge or card stock (or on one side only and divided by 2).
5. Removed bolt.
6. Peeled laminated shims (6510411022-101).
7. Placed laminated shims on each side of pressure plate lug.
8. Installed bolt.
9. Indicated when .004 to .008" clearance on each side of pressure plate lug is achieved.
10. Installed bolt, with bolthead facing in direction of rotation, and countersunk side of washer facing bolthead, through upper and pressure plate lug.

Assume you have torqued the nut; for testing purposes, tighten with wrench and continue the task.

11. Installed cotter pin (MS24665-376).
12. Wiped off excess compound.
13. Used new cotter pin.

- 1 CH-53E
- 1 TM A1-H53BE-140-000, 017 00, change 1-15, October 1983
- 2 7/16" Open-ended wrenches
- 1 Screwdriver
- 1 12" ruler
- 1 Channel locks
- Screwjack (replacement) fully extended
- Droplight/flashlight
- Nose avionics work stool
- Parts bag
- FOD container

Procedure to Set Up Station

1. Open #1 and #2 electronic door.
2. Open nose electronic door.
3. Mechanical screwjack should be fully retracted.
4. Hand tighten front end of mechanical screwjack.
5. Wrench tighten rear end of mechanical screwjack (connecting to bellcrank) and insert cotter pin.
6. Wrench tighten flex cable.

Procedures To Be Performed Before Testing Each Marine

1. Replace the screwjack.
2. Re-adjust the replacement screwjack by fully extending it.

Procedures to Administer and Score Test

1. Scorer may assist Marine in steps 12 and 13 by moving pedals.

This test covers your ability to remove the copilot's outboard mechanical screwjack from this aircraft. Assume you have received the necessary MAFS from maintenance control. Do you have any questions? Begin.

How would you adjust this new screwjack? [Hand fully retracted screwjack to Marine.]

NOTE TO SCORER: Work package instructs Marine to turn screwjack nut clockwise, the nut should be turned counterclockwise.

1. Disconnected flexible cable end from screwjack with channel locks.
2. Unbolted and disconnected fixed end of screwjack from bellcrank with open end wrench.
3. Unbolted and disconnected front of screwjack from bottom of pedal while reaching through nose electronics compartment with open end wrench.
- *4. Removed screwjack.
5. Inserted screwdriver in drive slot of old screwjack and turned screwdriver counterclockwise until screwjack is fully retracted.
6. Measured length on removed rod between centers of adjustable rod end and fixed end using 12" ruler.
7. Recorded measurement.
8. Loosened jamnut on replacement rod.
9. Turned adjustable rod end on the replacement rod until it is the same length as removed screwjack.
10. Measured distance from center of adjustable rod end to top of screwjack. (The distance should be less than 1.093".)

What would you do if the distance was 2 inches?

Now replace the screwjack [hand original screwjack to Marine]. Hand tighten only the front end and wrench tighten the back and flex cable.

-
11. Marine said he would replace screwjack.
 12. Tightened jamnut.
 13. Connected fixed end of screwjack to bellcrank and replaced the bolt wrench tight.
 14. Connected front end of screwjack to bottom of pedal and replaced the bolt hand tight. ..
 15. Connected the flex cable to the screwjack wrench tight.

- 1 CH-53E
- 1 TM A1-H53BE-TTM-000, WP050 00, pg. 13
- 1 TM A1-H53BE-220-000, WP018 00, pg. 23
- Rags
- Wrench
- Slot head screwdriver
- Flashlight/droplight
- Cotter pin

Procedure to Set Up Station

1. Turn off electrical power.
2. Remove panels covering selector key as necessary.
3. Insure interior of aircraft is well lighted.

Procedures To Be Performed Before Testing Each Marine

1. Move fuel selector to OFF position.
2. Reset selector key to the 5 o'clock position.

The pilot reported that the #3 engine would not start. Ignition was heard, the engine motorizes but no fuel is seen. You are to troubleshoot the problem or problems. Show and tell me what you are doing. Do you have any questions? Begin.

NOTE TO SCORER:

Give the Marine 5 minutes to identify the fuel selector valve key, then show him its location and score Step 1 NO-GO.

1. Began the test without intervention.
2. Located and checked the No. 3 engine fuel selector valve key. (Not at the 6 o'clock position.)

3. Checked that the fuel selector is in the OFF position.
4. Removed access panels in the cockpit. (Two to the rear of the fuel selector and one to the right.)
5. Removed cotter pin, nut and bolt connecting the selector lever arm to the selector valve control cable.
6. Loosened the jamnut holding the adjustable cable end to the control cable.
7. Pulled the control cable so that the selector valve key moves to the 6 o'clock position.
8. Tightened the jamnut on the control cable.
9. Connected the selection valve control cable to the selector arm using a bolt, nut and cotter pin.
10. Checked to see if the selector valve key is in the 6 o'clock position.

NOTE TO SCORER:

If key is not in the 6 o'clock position, allow Marine to attempt to reset the key only one more time.
If unsuccessful, score Step 12 NO-GO.

11. Replaced cockpit accessory panels.

*12. Fuel selection key was reset to the 6 o'clock position.

- 1 CH-53E
- TM A1-H53BE-140-000 WP007 00, pp. 23-27
- 2 Combination Wrenches
- 1 Ratchet
- 1 Socket
- 1 6" Extension
- Cotter Pins
- Drop light

Procedure to Set Up Station

1. Interior of aircraft needs to be well lit.
2. Turn off all electrical and hydraulic power.
3. Remove broom closet panel.
4. Remove structural panel below broom panel.
5. Open #2 avionics compartment door.
6. Disconnect collective control rod from upper end of broom closet (so TA can move collective stick).
7. Disconnect lower end of collective bottom spring.
8. Construct card with aircraft serial number.
9. Wrench tighten all nuts except the AFCS collective servo input bellcrank which should be torqued.
10. Remove secondary balance spring.

Procedures To Be Performed Before Testing Each Marine

1. Make sure bellcrank installed completely before testing.

I want you to remove and replace the collective input bellcrank. Assume rig pins and blocks are installed. Do you have any questions? Begin.

NOTE TO SCORER: If Marine has not done all steps correctly, remove all necessary parts before starting replace.

Do not remove the input bellcrank. Now reassemble the collective input bellcrank and torque only the AFCS control rod. Replace nuts finger tight and insert cotter pins.

NOTE TO SCORER: Move collective stick so Marine can align control rods.

1. Began task without intervention.
2. Disconnected AFCS collective servo input central rod.
3. Disconnected balance spring extender from collective input bellcrank with wrench.
4. Rotated balance spring extender aft for clearance.
5. Disconnected control rod from bellcrank.
6. Connected control rods to bellcrank using bolts, washers, and nuts using wrench.
7. Tightened nut (hand tight).
8. Installed cotter pins.
9. Aligned control rods.
10. Connected balance spring extender to collective input bellcrank using bolt, washers, nylon washer (64510-03110-111), and nut using wrench.

11. Tightened nut (hand tight).
12. Installed cotter pin.
13. Installed AFCS collective servo input control rod.
14. Torqued nut to 30-50 inch pounds.
15. Installed cotter pin.
16. Used new cotter pins throughout task.

1 CH-53E

1 TM A1-H53BE-MRC-300:card 46-46.3; (Handout A)
card 50-50.2; (Handout B)
card 55-55.2; (Handout C)
card 64-64.2; (Handout D)

Shims

Mirror

Procedure to Set Up Station

1. Open main rotor head work platforms.
2. Position main rotor blade over helicopter nose or tailcone.
3. Select a pitch link to troubleshoot.
4. Remove cotter pin on rotating scissors.
5. Remove cotter pin from main rotor pitch control rod.

Procedures to Score and Administer Test

1. For TA information: This test includes four separate troubleshooting procedures.
2. There is a TM extract for each separate troubleshooting scenario.

The pilot suspects worn damper bearing on #1 blade. Troubleshoot both the outboard and the inboard damper bearing using these MRC cards. Begin with the outboard damper bearing. [Hand Marine Handout A.] Assume blades are installed. I will assist you if needed. Show and tell me what you are doing. Are there any questions? Begin.

NOTE TO SCORER: If asked, say assume blade is being pushed/pulled.

What would you do if the shim (gage) could be inserted 1/2" inch or more?

NOTE TO SCORER: If asked, say to assume that the blade is being pushed/pulled.

Now, troubleshoot the inboard damper bearing. [Hand Marine Handout B.]

Assume you have removed the bearing. You inspect for metal-to-metal contact by rotating the spherical bearing in outer race. A scraping condition exists. What would you do?

Here is another situation. During flight, the pilot felt a vertical beat and suspects a worn pitch link. [Hand Marine Handout C.] Show me and tell me what you are doing.

1. Visually inspected horizontal hinge pin restrainer assembly inboard side for missing or obviously worn nylon bumpers.
2. Asked scorer to apply hand force to damper body by pulling in direction of side where measurement is to be taken.
3. Probed 360 degree circumference of outboard side of outboard bearings using 0.005-inch gauge (light blue) for the SB5073-102 bearing OR a 0.010-inch gauge (brown) for the SB5073-103 bearing (brown ring).
4. Visually inspected outboard half of outboard bearing for metal-to-metal contact on the inboard (flange) side.
5. Marine said he would replace bearing.
6. Probed outside position of inboard bearing (rod end) using 0.005" plastic shim without pulling in the direction of side where measurement is to be taken.
7. Probed inside portion of inboard bearing (rod end) using 0.005" plastic shim.
8. Marine said he would return damper and bearing to depot level maintenance.
9. Visually inspected main rotor pitch control rod for missing cotter pins, safety wire and loose jam nuts.
- *10. Detected missing cotter pin.

What would you do if you could not insert the shim 0.300"?

The crew chief suspects loose rotating scissors. Troubleshoot rotating scissors and ensure that they are within tolerances. [Hand Marine Handout D.] Show and tell me what you are doing.

11. Applied hand force to pitch control rod by pulling in direction of side where measurement is to be taken without twisting the rod.
12. Probed entire 360 degree circumference of both sides of upper bearing using 0.010" shim.
13. Probed entire 360 degree circumference of both sides of lower bearing using 0.010" shim.
14. Visually inspected upper and lower bearing for wear on non-staked side of outer bearing race.

15. Marine indicated that the bearing would not have to be replaced.

16. Moved the squash plate to see if the bearings of the rotating scissors bind.
17. Attempted to move bolts by hand.
18. Inspected the bearing retainer bracket for binding, missing bolts, safety wire, and misalignment on the bottom of the rotating scissors.
19. Detected missing cotter pin.
20. Probed 360 degrees of linkage joints on rotating scissors upper link bearing with 0.015" metal feeler gauge.

21. Probed 360 degrees of linkage joints on rotating scissors lower link bearing
with 0.015" metal feeler gauge.
22. Probed 360 degrees on both sides of rotating scissors spherical bearing using
0.010" thick plastic shim stock

- 1 CH-53E
- 1 TM A1-H53BE-150-000 005 00, change 8-15, 1988, pp. 5-16A
- Depth micrometer
- 3/4" socket
- 7/8" deep well socket
- Ratchet and extension
- 7/16" socket

Procedure to Set Up Station

1. Remove rotor blades.
2. Remove fairing.
3. Remove bladefold junction box (pie plate).
4. Discharge nitrogen pressure on damper accumulator.
5. Remove damper accumulator and attaching lines.
6. Cap off hydraulic lines.
7. Break torque and then hand tighten the 12 retaining nut bolts and the 2 bolts securing the damper assembly plate to hub.
8. Place wrap in main gear box output shaft

Procedures To Be Performed Before Testing Each Marine

1. Install all components before testing.

This task involves removing and replacing the main rotor head. To begin, tell me how you would break the torque of the 18 lower pressure plate bolts [point]? Do you have any questions? Begin.

In what sequence would you break the torque on these bolts?

Now, remove the rotor head retaining nut. Assume for testing purposes everything is torqued. All bolts are hand tight.

For testing purposes, assume you have removed the lower pressure plate, disconnected the control rods, removed the main rotor head, and a new rotor head is installed.
Now replace what you have removed beginning with the application of this antiseize compound. [Hand to mechanic.]

1. Said torque broken in 200 foot-pound increments.
2. Said by numerical order (1, 2, 3, 4...).
3. Removed the 12 bolts and checknuts from retaining nut in sequence (1, 2, 3, 4...).
4. Removed the two bolts, spacers, and washers that secure damper accumulator pie plate to hub assembly. ...
5. Removed damper accumulator plate.
6. Removed retaining nut and thrust washer. (Keep with main rotor head.)
7. Installed main rotor head thrust washer, and by hand, screwed retaining nut on shaft with the word TOP and counterbore holes facing up.
8. Backed off retaining nut, by hand, one full turn (to allow installation of damper accumulator plate).
9. Measured space between retaining nut and shaft with depth micrometer.
10. Aligned holes in two ears of damper accumulator plate with two holes in top of hub that are about 50 degrees apart and at centerline of blade positions one and seven.

What is your next step?

Continue

Tell me what you would do next?

11. Installed two spacers, washers, and bolts.

12. Said would torque bolts to 104-116 inch-pounds.
13. Said would lockwire bolts.

14. Installed checknuts on main rotor head retaining nut bolts and installed 12 bolt assemblies into retaining nut.
15. Tightened finger-tight.

16. Said would torque bolts to 16 - 18 foot-pounds until stabilized.

- 1 CH-53E
- 1 TM A1-H53BE-260-000, WP012 00, pg. 28-29
- Flashlight/droplight
- Rags
- Packing (M83248/1-024)
- Torque wrench 120 pound-inch
- Container for oil
- 7/16" wrench
- 7/16" socket
- 11/16" wrench

Procedure to Set Up Station

1. Turn off all electrical power.
2. Remove sound absorbing panels.
3. Break the torque on the chip detector.
4. Open and lower main gear box drip pan.

Procedures to Score and Administer Test

1. Step 5 must be performed before step 6.

The crew chief reported that the #5 (aux lube) chip light indicator became lit during flight. You are told to troubleshoot this gripe. Do you have any questions? Begin.

NOTE TO SCORER: If Marine does not do Step 5 before attempting Step 6, score Step 5 NO-GO.

1. Began test without intervention.
2. Disconnected electrical connector from the auxiliary lubrication chip detector/strainer.
3. Placed oil container under detector.
4. Removed the bolt and washer from the chip detector/strainer.
5. Twisted chip detector strainer and sleeve (90°) 1/4 turn clockwise, shutting off oil flow.
6. Removed the chip detector/strainer from sleeve in the main gear box sump.
7. Removed the strainer from the chip detector by pressing in on the strainer and turning counterclockwise until the bayonet slot releases from the chip detector pin.
8. Removed all chips from the chip detector and strainer.
9. Wiped all surfaces of the strainer and chip detector.
10. Installed chip detector onto the strainer by aligning the bayonet slot with the pin and then pressed and turned the strainer clockwise locking into place.

11. Pushed the chip detector/strainer into the chip sleeve by aligning the chip detector/strainer pin with sleeve hole.
12. Turned chip detector/strainer and sleeve 1/4 (90°) turn counterclockwise and aligned bolt holes.
13. Installed the bolt and washer on the chip detector/strainer, connecting it to the main gear box sump.
14. Torqued bolt 105 to 115 inch-pounds.
15. Inserted the electrical connector onto the chip detector.

- 1 CH-53E
- 1 TM A1-H53BE-260-000, WP009 00, pp. 28-30
 - 1/2" wrench
 - 9/16" wrench
 - Rags
 - Safety wire
 - Safety wire pliers
 - Sealing washers

Procedure to Set Up Station

1. Turn off all electrical power.
2. Position rotor head to allow clearance.
3. Remove or open access panels.
4. Break torque.
5. Remove safety wire from bolt attaching filter to accessory gear box.

Procedures To Be Performed Before Testing Each Marine

1. Oil filter must be completely installed as shown in the picture below.

Procedures to Administer and Score Test

1. For steps 17 to 19 have Marine show and tell what he would do.

You have received a MAF'S from Maintenance Control that instructs you to remove, disassemble, reassemble and replace the accessory gear box oil filter. Do not remove packing. Do you have any questions? Begin.

How would you clean this filter?

1. Removed bolt connecting filter to the main gear box and remove filter.
2. Removed bolt and sealing washer from filter housing.
3. Removed filter housing.
4. Removed filter disc assembly.
5. Removed lock wire.
6. Removed spring and washer.
7. Removed nut and retainer from filter disc assembly and tube.
8. Removed all filter discs and spacers from tube.
9. Checked filter discs for metal shavings.
10. Said would clean discs, spacers, tube, spring, nut, retainer, and filter housing with solvent (Fed Spec P-D-680, Type II).

Now, install the oil filter using the materials available.

Now, show and tell me what you would do next.

Continue.

Now, show and tell me what you do next.

-
11. Alternated stacking discs and spacers on tube (i.e., create filter disc assembly by placing the washer on the bolt, then stacking discs and spacers). (See figure.)
 12. Installed retainer and nut on the tube.
 13. Inserted filter disc assembly into filter housing.
 14. Safety wired nut.
-
15. Would apply thin coat of epoxy polyamide primer to face of filter body.
-
- *16. Installed filter back onto gearbox and tightened nut.
-
17. Would apply a fillet of sealing compound (MIL-S-8802, Class B, Type II) to filter housing and gear box mating seam.
 18. Would coat bolthead and exposed lockwire with sealing compound.
 19. Would apply thin coat of epoxy polyamide primer (MIL-P-23377, Type II) over sealing compound.

- 1 CH-53E
- 1 TM A1-H53BE-GAI-000, WP010 00, pg. 11
- Rags
- Slot head screwdriver
- Flashlight/droplight
- Oil (MIL-L-23699)
- Container for oil

Procedure to Set Up Station

1. Connect external power.
2. Test all warning and tank full lights for proper operation.
3. Drain sufficient oil from the #1 engine oil tank so that the oil tank full lights will activate.

Procedures To Be Performed Before Testing Each Marine

1. Drain oil from engine oil tank until the master caution light comes on.

AD-R264 986

JOB PERFORMANCE TESTS FOR CH-53E HELICOPTER RECONNAISSANCE
(U) CENTER FOR NAVAL ANALYSES ALEXANDRIA VA OPERATIONS
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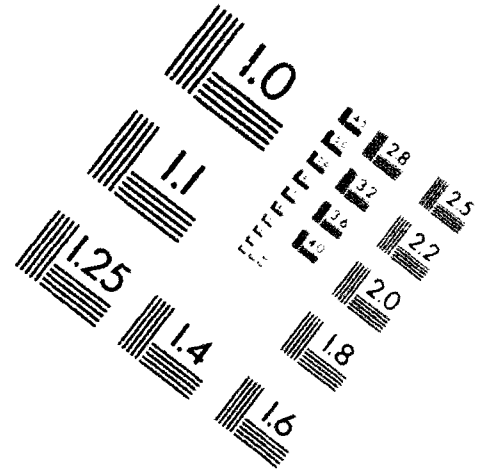
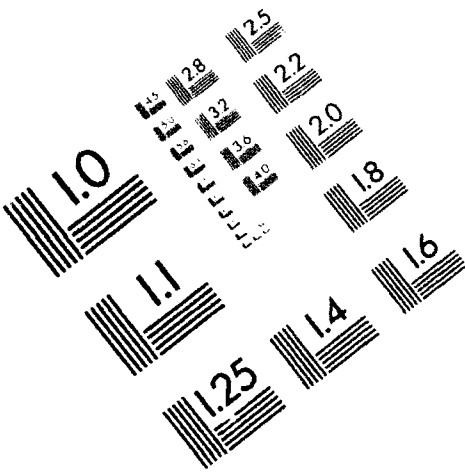


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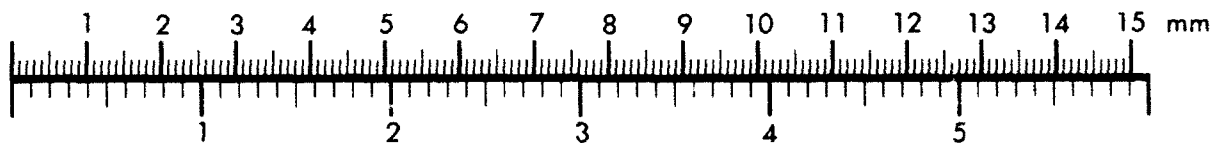
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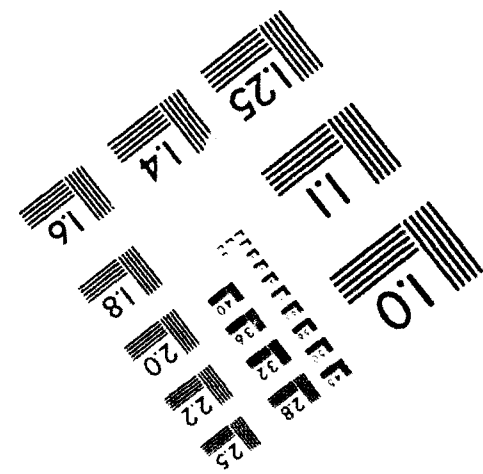
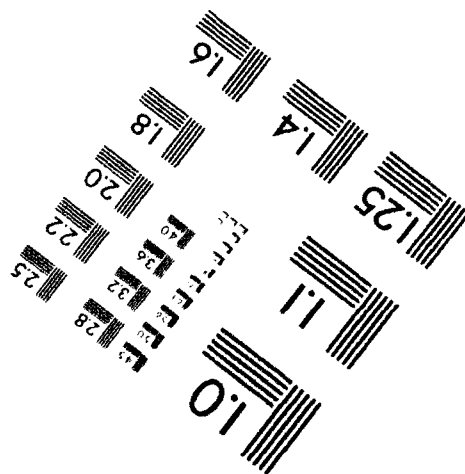
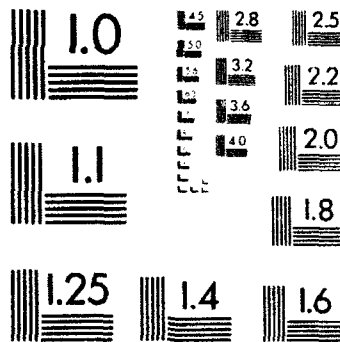
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Centimeter



Inches



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The crew chief reported that the No. 1 engine oil tank full warning light went off just before landing. He tells you to check the problem. Any questions? Begin.

NOTE TO SCORER: If Marine selects the wrong valve, open the correct valve and score step 4 NO-GO.

Show and tell me what you would do if the oil is at this level. [Indicate a low level.]

-
1. Turned power on.
 2. Pressed light test button.
 3. Checked ENGINE OIL TANK FULL lights and ENG OIL QTY LOW lights on caution panel. (OIL TANK light for engine #1 is off, ENG QTY LOW light is on.)
 4. Opened control valve for the #1 engine oil tank.
-
5. Operated handpump back and forth until ENGINE OIL TANK FULL light goes on.
 6. Checked that the ENG OIL QTY LOW light on the caution/advisory panel went off.
-
7. Indicated would fill tank with oil.

Equipment/Materials Required

Remove/Replace Power Pant Fuel Boost Pump

- 1 CH-53E
TM A1-H53BE-460-000, WP 01900, pg. 1-4
Rags
1/2" Socket
Caps
Plugs
Waste container
15" Crescent wrench
9/16" Wrench
1/2" Wrench
3/8" Wrench
Flashlight
Bolts
Washers
Nuts

Procedure to Set Up Station

1. Release fasteners on outboard nacelle panel.
2. Lift panel up and lock into place.
3. Place helicopter in well ventilated area.
4. Predrain fuel - see step 1d. in the work packet.
5. Run through the test.

Procedures To Be Performed Before Testing Each Marine

1. Fuel boost pump must be completely installed before testing.

Procedures to Score and Administer Test

1. Make certain that all components, bolts, etc., have been removed before having the Marine replace the fuel boost pump at step 11.
2. Alternate removing and replacing O-rings with examiners.
3. Step 11 normally requires quality assurance (QA) notification; TA serves that role if asked by the Marine.

This test covers your ability to remove and replace the fuel boost pump on the #3 engine as you would so in the field. Do not disassemble the com? on the pump. Do not remove seal packing or gasket. Do you have any questions?

1. Began test without intervention.
2. Disconnected electrical connector from the pressure switch.
3. Installed protective cover on the electrical connector and plug.
4. Drained residual fuel from the fuel lines.
5. Capped/plugged lines, fittings and ports.
6. Disconnected fuel hose from the adapter fitting on the inlet port.
7. Disconnected fuel hose from the adapter fitting on the outlet port.
8. Disconnected the boost pump sump drain.
9. Removed 6 nuts and washers connecting the boost pump to the mounting bracket.
10. Removed the wiring harness bracket and fuel line bracket from bolts.

Now, install the boost pump. Wrench tighten only. Do not torque the bolts.

- *11. Slid pump off bolts.
- 12. Slid pump onto the 6 bolts with the drain port on the bottom and while aligning spliner. .
- 13. Replaced wiring harness and fuel line brackets on the bolts.
- 14. Installed 6 washers and nuts on to the bolts.
- 15. Connected the fuel hose from the adapter fitting to the outlet port.
- 16. Connected the fuel hose from the adapter fitting to the inlet port.
- 17. Connected the electrical connector to the pressure switch.
- *18. Reinstalled pump correctly (meets all standards).